REMARKS

Claims 1-26 stand rejected under 35 U.S.C. §101, on prior art grounds and upon informalities. Applicants respectfully traverse these rejections based on the following discussion. The limitations of dependent claims 3, 9, 16 and 22 are amended into their respective independent claims. Thus, claims 3, 9, 16 and 22 are canceled and claims 1-2, 4-8, 10-15, 17-21 and 23-26 are all the claims presently pending in the application.

I. The 35 U.S.C. §101 Rejection

In rejecting independent claims 1, 8, 14 and 20 under 35 U.S.C. §101 for being directed to non-statutory subject matter, the Examiner indicated that *In re Warmerdam*, 33 F.3d 1354, 31 USPQ2d 1754 (Fed. Cir. 1994), which held that "...Taking several abstract ideas and manipulating them together adds nothing to the basic equation", was controlling. Specifically, the Examiner determined that the claimed invention did not have a useful, concrete and tangible result because the Appellant "manipulated a set of abstract 'history files' to solve purely algorithmic problems in the abstract". The Examiner further provided that "the fact that the invention is merely the manipulation of abstract ideas is clear. The data referred to by Applicant's idea of "history files" is simply an abstract construct that does not provide limitations in the claims to the transformation of real world data (such as monetary data or heart rhythm data) by some disclosed process. Consequently, the necessary conclusion under AT&T, State Street and Warmerdam, is straight forward and clear. The claims take several abstract ideas (i.e., "history files" in the abstract) and manipulate them together adding nothing to the basic equation." The Applicants respectfully disagree.

Independent claims 1, 8, 14 and 20 each include the claim limitations of "recording features of normal system operations in a history file," "creating a model for each of said features of said normal system operations in said history file," and "reporting said anomalous events." These limitations imply that during normal system operations features of the system are determined and anomalous events are reported in some manner. The features are then recorded (e.g., as historical data) in a history file. Then, for each feature in the history file, a model is created. This aspect of the invention is explained in detail throughout the disclosure. For example, the Abstract provides that the system records actions performed as features in a history file and automatically creates a model for each feature. Paragraphs [0006] and [0023] provide that the invention begins with historical data maintained in a history file and that a model is created for each feature only from normal data in the history file. Paragraph [0020] references a dataset of N features from which N models are created. Therefore, the Applicants submit that contrary to the Examiner's finding the "history files" are not just abstract ideas, but rather contain real world data (i.e., a recording of features of normal system operations) from which models are created (i.e., a model is created for each feature of normal system operations that is recorded).

Furthermore, if, as indicated by the Examiner, the data referred to by the "history files" is simply an abstract construct that did not provide limitations in the claims to the transformation of real world data by some disclosed process, it was still incumbent upon the Examiner to determine whether the method otherwise produces a useful, concrete or tangible result. That is, it is generally understood that to establish utility under 35 U.S.C. §101 method inventions as a whole must produce a "useful, concrete and tangible result." (see *State Street*, 149 F.3d at 1373-

74, 47 USPQ2d at 1601-02). Additionally, *AT&T Corp v. Excel Communications, Inc.* 172 F.3d 1352, 1358-59, 50 USPQ2d 1447, 1452 (Fed. Cir. 1999) provides that physical transformation "is not an invariable requirement, but merely one example, of how a mathematical algorithm [or law of nature] may bring about a useful application." If the Examiner determines that there is no physical transformation, additional review is required to determine if the claim provides a useful, tangible and concrete result. The review by the Examiner should focus not on each step, but on whether the final result achieved by the claimed invention is "useful, concrete and tangible" (see AT&T 172 F.3d at 1358-5).

The Applicants submit that the results of the method embodiments disclosed are "useful." Specifically, the Applicants submit that a credible, specific, and substantial use for the method of the invention (namely identifying and reporting anomalous events that occur during system operations) is readily apparent and well-established in the independent claims themselves. That is, each of the independent claims provides for a method of automatically identifying and reporting anomalous situations that occur during system operations. The limiting features in each of the claims include, but are not limited to, the following: (1) "recording features of normal system operations in a history file;" (2) "automatically creating a model for each of said features of said normal system operations in said history file;" (3) "calculating anomaly scores of said features of said normal system operations and storing said anomaly scores in a trained file;" (4) "establishing a threshold to evaluate whether events in live system operations are anomalies as compared to said normal system operations;" (5) "automatically ***identifying anomalous events in said live system operations*** based on said anomaly scores and on said threshold;" (6) "***reporting said anomalous events***;" and (7) "periodically repeating said calculating."

Independent claim 8 further includes the additional limiting features of ""wherein said creating of said model for each of said features comprises: establishing relationships that exist between each of said features for said normal system operations; selecting a labeled feature from said features; mathematically rearranging said relationships from the point of view of said labeled feature to create a solution for said labeled feature, wherein said solution comprises a model for said labeled feature; selecting different features as said labeled feature and repeating said process of mathematically rearranging said relationships to produce solutions from the point of view of each remaining feature as models for the remaining features." Independent claim 14 further includes the additional limiting features of "wherein said calculating comprises: predicting a likelihood that each feature will be normal when one or more of the other features are abnormal, using said model of each of said features; repeating said predicting using different presumptions about other features being normal and abnormal to produce said trained file of a plurality of anomaly scores for each of said features." Those skilled in the art would immediately appreciate why the invention is useful (i.e., would appreciate why it is important to be able to identify when anomalous events occur during system operations and to report out the occurrence of those anomalous events). For example, as set out in paragraph [0063] of the specification, the invention, which identifies and reports anomalous events, can be applicable to self-diagnosis, anomaly detection, outlier detection and skewed distribution data mining (i.e., it is useful in a number of different applications.)

More specifically, credible, specific, and substantial uses for the method of the invention (namely identifying and reporting anomalous events that occur during live system operations) are asserted throughout the specification. Paragraph [0004] provides that in order to achieve a goal

of autonomic computing it is important that a target system be able to perform self-diagnosis. Per paragraph [0018], the claimed invention provides a general solution to conventional problems associated with self-diagnosis by providing a method that uses an additive approach to combine evidence from multiple sources (i.e., history files) and then uses a probabilitstic thresholding approach to detect anomalies. These detected anomalies can be reported to a system user (see paragraph [0063]). Paragraph [0063] provides that the invention applicable to self-diagnosis, anomaly detection, outlier detection and skewed distribution data mining (i.e., it is useful in a number of different applications.) and further detail in what manner it is applicable. Per paragraph [0064], the claimed invention is superior to prior art systems because it takes advantage of inter-feature correlation and predicts the value of one feature using values of other features and because it uses a threshold to predict anomalies.

Furthermore, the Applicants submit that the results of the method embodiments disclosed are not only useful, but "tangible" and "concrete." Specifically, the claim limitations of "identifying anomalous events in said live system operations" and "reporting said anomalous events" are beneficial real-world results of performing the method of the invention (i.e., they are tangible and not abstract results, see *Gottschalk v. Benson*, 409 U.S. 63, 71-72, 175 USPQ 673, 676 (1972)). That is, as system operations occur, the method is able to identify anomalous events that occur and to report out those events. The process steps are not abstract or theoretical. Additionally, the claim limitations of "identifying anomalous events in said live system operations" and "reporting said anomalous events" are substantially repeatable (i.e., concrete, see In re Swartz, 232 F.3d 862, 864, 56 USPQ2d 1703, 1704 (Fed. Cir. 2000). That is, as the live system operations proceed, the method will be able to identify and report out each anomalous

event that occurs. The identification process is based on the previously calculated anomaly scores and previously established threshold. To ensure that the anomalous events will continue to be properly identified throughout the live system operations, the claim limitation of periodically recalculating the anomaly scores is also included.

Therefore, independent claims 1, 8, 14 and 20 are directed to statutory subject matter under 35 U.S.C. §101. Further, dependent claims 2-7, 9-13, 14-19 and 21-26 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

II. The 35 U.S.C. §112, Second Paragraph, Rejection

The Office Action provides that claims 1-26 are rejected under 35 U.S.C. §112, first paragraph because the current case law (and accordingly, the MPEP) require such a rejection if a §101 rejection is given because when Applicant has not in fact disclosed the practical application for the invention, as a matter of law there is no way Applicant could have disclosed how to practice the undisclosed practically application.

State Street, 149 F.3d at 1373-74, 47 USPQ2d at 1601-02 provides that to be eligible for patent protection, the claimed invention as a whole must accomplish a practical application (i.e., it must produce a "useful, concrete and tangible result"). As discussed in detail above with regard to the rejection of claims 1-26 under 35 U.S.C. §101 the claimed invention does produce

such concrete and tangible result, namely "identifying anomalous events in said live system operations" and "reporting said anomalous events". Further, as discussed in detail above, this concrete and tangible result can be applicable to self-diagnosis, anomaly detection, outlier detection and skewed distribution data mining (i.e., it is useful in a number of different applications.) Given the fact that the only basis for the rejection of claims 1-26 under 35 U.S.C. §112 is the existence of the rejection of those claims under 35 U.S.C §101 rejections, the Examiner is respectfully requested to reconsider and withdraw the rejections.

III. The Prior Art Rejections

Claims 1-26 stand rejected under 35 U.S.C. §102(e) as being anticipated by Klein (U.S. Patent No. 7,027,953). Applicants respectfully traverse these rejections based on the following discussion.

Specifically, the Applicants submit that Klein does not teach or suggest the following patentable features of amended independent claims 1, 8, 14 and 20: (1) "A method of automatically identifying anomalous situations during operations of a computerized system;" (2) "automatically creating a model for each of said features of said normal operations in said history file, wherein said model comprises a mathematical statement indicating what a corresponding feature equals in terms of relationships with all other features;" (3) "calculating anomaly scores of said features of said normal operations and storing said anomaly scores in a trained file, wherein said anomaly scores are predictive of whether each of said features will be normal when one or more of the other features are abnormal;" and (4) "automatically identifying anomalous events in said live operations based on said anomaly scores and on said threshold;"

More specifically, Klein does not teach or suggest the claimed method "of automatically identifying anomalous situations during operations of a computerized system". Rather, per the claims, Klein teaches a health maintenance system for a mechanical system (see independent claim 1), a heath prognosis method for a mechanical system (see independent claim 4), a method for providing a health indication for a mechanical system (see independent claim 12) and a computer implemented health diagnostic system for a mechanical system (see independent claim 14). That is, each of the embodiments of Klein refer to a method/system for diagnosing or maintaining the health of a mechanical system, not for identifying anomalous situations that occur during the operation of a computerized system, as claimed in the present invention.

Specifically, an overview of the three-stage diagnostic method of Klein is provided at col. 6, lines 14-45. That is, the first stage of Klein is engine vibration data processing, which includes data evaluation, outlier's elimination (elimination of clearly invalid data) and trend smoothing. The second stage is feature extraction, where that features are snapshot, short-term shifts, long-term shifts and varying-term shifts, each of which provide different information about an engine. The third stage is classification, where each of the features is classified by several diagnostic methods. Figure 5 and the associated text at col. 9, lines 20-67, describe these stages in more detail. That is, in the first stage, normal and defective vibration signatures are stored 440. Furthermore, vibration data is collected and new signatures are created 450. In the second stage, features are extracted from the newly created signatures and compared with the features of known signatures 470. If a novel pattern of features is detected in a newly created signature, a new diagnostic cycle (i.e., the third stage) is triggered 480.

The Office Action cites col. 23, lines 54-63, of Klein as disclosing both the features of

"recording features of normal operations in a history file" and "automatically creating a model for each of said features of said normal operations". The Applicants respectfully disagree. As mentioned above, Figure 5, item 440, and the associated text, indicate that both normal signatures and defective signatures are stored. However, the cited portion of Klein does not disclose that models are automatically created for each of the features of normal operations, much less that such models comprise a mathematical statement indicating what a corresponding feature equals in terms of relationships with all other features. That is, as discussed above with regard to Figure 5, both normal and defective vibration signatures are stored and, then, during subsequent operation of the mechanical system (e.g., the engine) vibration data is collected, new signatures are created and the features of the new signatures are compared to known signatures. At col. 23, lines 40-54, Klein explains that once a novel signature is detected, the system is retrained so that the detected anomaly is considered a "known" defect for subsequent processing. The cited portion of Klein (i.e., col. 23, lines 40-54) refers to how this retraining is performed. Nowhere in Klein does it teach or discuss that models are created for each feature of normal operations or, more particularly, that these *models are mathematical statements indicating what a corresponding feature equals in terms of relationships with all other features of normal operations that are stored in the history file*.

The Office Action cites col. 2, lines 65-67 and col. 3, lines 1-8, of Klein as teach the feature of "calculating anomaly scores of said features". The Applicants respectfully disagree. The cited portion of Klein refers to the fact that vibration signatures in different domains are indicative of different types of faults. Every fault type is associated with a pointer that defines a frequency region of a vibrational pattern. The vibrational pattern is compared to a baseline

pattern for that fault type to produce an index which indicates a deviation from an expected normal pattern for that fault type. In other words, for a given fault type, Klein compares a collect vibration pattern to a previously established baseline to determine if the collected patter is normal and, more specifically, how far it deviates from normal. Contrarily, calculating feature of the present invention relates to stored features of normal operation and, more specifically, calculating anomaly scores of said features, wherein the anomaly scores are predictive of whether each of the features will be normal when one or more of the other features are abnormal. The indices of Klein reflect how abnormal a collected vibration signature, relative to normal, not how likely it is to be normal when others are abnormal. Nowhere does Klein teach or disclose "calculating anomaly scores of said features of said normal operations and storing said anomaly scores in a trained file, *wherein said anomaly scores are predictive of whether each of said features will be normal when one or more of the other features are abnormal*."

The Office Action cites col. 27, lines 13-15 and col. 28, lines 1-10 of Klein as disclosing the feature of "automatically identifying anomalous events in said live operations based on said anomaly scores and on said threshold." The Applicants respectfully disagree. Columns 27-28 describe the feature extraction process, wherein the actual signature of the system is compared to a baseline. The comparison is performed by calculating a set of diagnostic indexes for each predefined pointer in a failure pattern. The diagnostic indexes are aggregated using relative weights and an aggregate feature provides an indication of the health of the analyzed fault conditions, when compared to a threshold level. In the present invention, an event that is detected during live system operations is identified as anomalous or not based on a threshold, but also based on anomalous scores (which as discussed above are predictive in light of other

features being abnormal). Nowhere does Klein teach or disclose "automatically identifying anomalous events in said live operations *based on said anomaly scores and on said threshold*."

Therefore, the Applicants submit that independent claims 1, 8, 14 and 20 are patentable over Klein. Furthermore, dependent claims 2-7, 9-13, 14-19 and 21-26 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

IV. Formal Matters and Conclusion

With respect to the rejections to the claims, the claims have been amended, above, to overcome these rejections. In view of the foregoing, the Applicants submit that claims 1-2, 4-8, 10-15, 17-21 and 23-26, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. Therefore, the Examiner is respectfully requested to reconsider and withdraw the rejections to the claims and is further respectfully request to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary. Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 50-0510.

Respectfully submitted,

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